



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.          | CONFIRMATION NO. |
|-----------------|-------------|----------------------|------------------------------|------------------|
| 10/052,451      | 01/18/2002  | Rajiv Vasant Joshi   | 64,610-030A<br>(YO994-172AX) | 9238             |

30678 7590 10/21/2003

CONNOLLY BOVE LODGE & HUTZ LLP  
SUITE 800  
1990 M STREET NW  
WASHINGTON, DC 20036-3425

EXAMINER

BROPHY, JAMIE LYNN

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2822

DATE MAILED: 10/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/052,451

Applicant(s)

JOSHI, RAJIV VASANT

Examiner

J. L. Brophy

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 25 July 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 21,22,24,26-39,41-59,62 and 67-78 is/are pending in the application.
- 4a) Of the above claim(s) 28-39,41-59 and 62 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21,22,24,26,27 and 67-78 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

This office action is in response to the amendment and election filed 7/25/03.

#### ***Election/Restrictions***

Applicant's election without traverse of species 1, claims 21, 22, 24, 26, 27 and 67-78 in Paper No. 11 is acknowledged.

Claims 28-39, 41-59 and 62 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 11.

#### ***Claim Objections***

Claims 77 and 78 are objected to because of the following informalities: in line 2, there is insufficient antecedent basis for the limitation "said second layer".

Appropriate correction is required.

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 21, 22, 24, 26, 27 and 67-78 are rejected under 35 U.S.C. 102(b) as being anticipated by Joshi et al (6,030,895).

Joshi et al teach a method of making a soft metal conductor which comprises depositing a first layer of the soft metal containing grains having grain sizes of not less than 0.3  $\mu\text{m}$ ;

Depositing a layer of the soft metal containing grains having a grain size of not more than 50 nm and a layer thickness of not less than 600 nm prior to said deposition process of the first layer of soft metal so as to provide a substantially scratch-free surface upon polishing in a subsequent CMP step (col. 2, lines 52-61); and

Sequentially depositing a layer of Ti of less than 30 nm thick and a second layer of soft metal on top of the first soft metal layer, such that the anti-electromigration property of the soft metal conductor is improved when the Ti layer is converted to  $\text{TiAl}_3$  layer in a subsequent annealing process (col. 2, line 66 through col. 3, line 7),

Wherein the first soft metal layer is deposited by a technique selected from the group consisting of PVD, CVD, evaporation and collimation (col. 4, lines 21-26 and col. 7, lines 26-28),

Wherein the first soft metal layer has a thickness of at least 100 nm (col. 2, lines 20-25),

Wherein the soft metal is selected from the group consisting of Al, Cu, Ag, CuAg, CuAl, AgAl and CuAgAl (col. 8, lines 24-27), and

Wherein the first layer of the soft metal and the layer of the soft metal containing grains having a grain size of not more than 50 nm are deposited in opening located in low dielectric constant layer.

See, for example, Fig. 2 and accompanying text.

Claims 21, 22, 24, 26, 27, 70-73, 77 and 78 are rejected under 35 U.S.C. 102(b) as being anticipated by Merchant et al (5,523,259).

Merchant et al teach a method of making a soft metal conductor which comprises depositing a first layer 16.2 of the soft metal containing grains having grain sizes of not less than 0.3  $\mu\text{m}$  (col. 4, lines 62-65);

Depositing a layer 16.1 of the soft metal containing grains having a grain size of not more than 50 nm and a layer thickness of not less than 400 nm prior to said deposition process of the first layer of soft metal so as to provide a substantially scratch-free surface upon polishing in a subsequent CMP step (col. 4, lines 54-61); and

Sequentially depositing a layer of Ti 24 of less than 30 nm thick (col. 4, lines 23-25) and a second layer 16.3 of soft metal on top of the first soft metal layer 16.2, such that the anti-electromigration property of the soft metal conductor is improved when the Ti layer 24 is converted to  $\text{TiAl}_3$  layer in a subsequent annealing process (col. 4, lines 29-36),

Wherein the first soft metal layer is deposited by PVD (col. 4, line 8),

Wherein the first soft metal layer has a thickness of at least 100 nm (col. 5, lines 12-16),

Wherein the soft metal is CuAl (col. 4, lines 44-45), and

Wherein the first layer 16.2 of the soft metal and the layer 16.1 of the soft metal containing grains having a grain size of not more than 50 nm are deposited in opening 19 located in low dielectric constant layer 20.

See, for example, Figs. 3-7 and accompanying text.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 69 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merchant et al.

Merchant et al teach a method of making a soft metal conductor which comprises depositing an uppermost layer with a grain size of not less than 0.3  $\mu\text{m}$ . However, Merchant et al do not specifically teach that the layer thickness of the layer of the soft metal containing grains having a grain size of not more than 50 nm is not less than 600 nm.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and select an appropriate layer thickness. The selection of parameters such as energy, power, concentration, temperature, time, depth, thickness, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce

Art Unit: 2822

a new and unexpected result which is different in kind and not merely degree from results of prior art...such ranges are termed 'critical ranges' and the applicant has the burden of proving such criticality...More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In Re Aller* 105 USPQ 233, 235 (CCPA 1955). See also MPEP 2144.05.

### ***Response to Arguments***

Applicant's arguments filed 12/2/02 have been fully considered but they are not persuasive. Applicant argues (bottom of p. 5 of arguments filed 12/2/02) that Merchant et al fails to suggest employing a layer of a soft metal wherein the grain size is not more than 50 nm. However, Merchant et al teach a layer 16.1 of a soft metal wherein the grain size is less than 250 nm (col. 4, lines 54-55). Prior art which teaches a range within, overlapping, or touching the claimed range anticipates the claimed range (MPEP 2131.03).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to J. L. Brophy whose telephone number is (703) 308-6182. The examiner can normally be reached on M-F (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Q.L.B.

jlb

  
**AMIR ZARABIAN**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**